

ABSTRACT

The present invention provides a variety of microscale bioreactors (microfermentors) and microscale bioreactor arrays for use in culturing cells. The microfermentors include a vessel for culturing cells and means for providing oxygen to the interior of the vessel at a concentration sufficient to support cell growth, e.g., growth of bacterial cells. Depending on the embodiment, the microfermentor vessel may have various interior volumes less than approximately 1 ml. The microfermentors may include an aeration membrane and optionally a variety of sensing devices. The invention further provides a chamber to contain the microfermentors and microfermentor arrays and to provide environmental control. Certain of the microfermentors include a second chamber that may be used, e.g., to provide oxygen, nutrients, pH control, etc., to the culture vessel and/or to remove metabolites, etc. Various methods of using the microfermentors, e.g., to select optimum cell strains or bioprocess parameters are provided. The invention provides microreactors having a variety of different designs, some of which incorporate active stirring and/or have the capability to operate in batch or fed-batch mode. The invention further provides an apparatus and methods for simultaneous operation of a plurality of microreactors, with monitoring of the individual microreactors during a run. The invention further provides methods of performing gene expression analysis on cells cultured in microreactors.

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